

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
)	
SafeView, Inc. Request for Waiver of Sections 15.31 and 15.35)	ET Docket No. 04-373
of the Commission's Rules to Permit the Deployment of)	
Security Screening Portal Devices that Operate in the 24.25-30)	DA 04-3038
GHz Range)	
)	

OPPOSITION OF HUGHES NETWORK SYSTEMS, INC.

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OPPOSITION OF HUGHES NETWORK SYSTEMS, INC.

Hughes Network Systems, Inc. ("HNS") hereby opposes the August 18, 2004 Request for Waiver of SafeView, Inc. ("SafeView") in which SafeView seeks a waiver¹ of Sections 15.31(c) and 15.35(b) of the Commission's rules.² Contrary to SafeView's assertions, grant of a waiver would significantly increase the threat of harmful interference from its proposed devices into licensed operations in the 24 GHz and 28 GHz bands. Moreover, SafeView has failed to satisfy the Commission's standard for waiver. The Commission therefore should dismiss or deny SafeView's Waiver Request.

I. INTRODUCTION AND SUMMARY

SafeView has developed a device that it claims will enhance security measures in areas such as airports. This device employs near-millimeter waves to generate three dimensional holographic images of subjects being screened at security portals to help identify the concealment of items. The SafeView system contains two vertical masts that rotate around the

¹ SafeView Request for Waiver (filed in ET Docket No. 04-373 on Aug. 18, 2004) ("Waiver Request").

² 47 C.F.R. §§15.31(c), 15.35(b).

subject being screened, while the device's antenna element sweeps from 24.25-30 GHz.

SafeView seeks a waiver of two of the Commission's Part 15 rules. First, SafeView seeks a waiver of the Section 15.31(c) requirement that it measure emissions from its device with the frequency sweep stopped. SafeView does not claim that it is infeasible to measure emissions in this manner. Rather, SafeView claims that measuring emissions with the sweep stopped "overstate[s] the interference potential" to licensed services.³ Second, SafeView seeks a waiver of Section 15.31(b), which limits peak emissions to 21 dB above the maximum average permitted power level. In this case, Section 15.209(a) limits average power of the SafeView device to -41.25 dBm. SafeView seeks permission to produce Part 15 devices with a peak power level of 0dBm, or 41 dB over the limit.

As one of the manufacturers of microwave communications equipment used by licensees operating in the 24 and 28 GHz frequency bands, through which the SafeView device sweeps, HNS is particularly concerned about the interference potential of this proposed unlicensed device into equipment that is used by FCC licensees for licensed operations. The Part 15 rules make very clear that SafeView's transmitters must operate without causing harmful interference to licensed devices.

Although SafeView styles its pleading as a request for a waiver of the Commission's measurement methods and its peak emissions limits, the real effect of SafeView's request would be to allow it to exceed the average radiated emissions limits set forth in Section 15.209(a) by a factor of 12,600. If SafeView's Waiver Request is granted, its device therefore poses a significant threat to microwave communications equipment and services operating in the 24 and 28 GHz bands. At bottom, SafeView fails to show good cause for a waiver.

³ Waiver Request at 2.

Accordingly, the Commission should dismiss or deny SafeView's Waiver Request.

II. DISCUSSION

A. SafeView Does Not Satisfy the Standard for a Waiver

As an initial matter, SafeView fails to satisfy the standard for a waiver of the Commission's rules. Section 1.3 provides that the Commission may waive its rules "for good cause shown."⁴ More specifically, an applicant seeking a rule waiver "must plead with particularity the facts and circumstances which warrant such action and give affirmative reasons to justify grant of the waiver in the public interest."⁵

SafeView has not demonstrated good cause for waiving Sections 15.31(c) and 15.35(b) of the Commission's rules. SafeView provides not a shred of analysis to support its claims that microwave systems in the 24 GHz and 28 GHz bands are "unlikely to receive interference" from its devices. SafeView has not identified the typical characteristics of any licensed systems operating in the bands for which it seeks waivers, and it has not conducted an interference analysis of the victim systems. Indeed, the only technical analysis consists of some calculations of the duty cycle of the SafeView device, which HNS shows are wrong. SafeView provides no support for its claims that "building attenuation alone at 24-30 GHz should be enough to bring emissions close to compliance."⁶ And SafeView fails to substantiate its assertion that "there are no indoor victim receivers."⁷ As demonstrated below, both those claims are false. Moreover, SafeView has not attached a single declaration in support of its claims, or substantiated its claims with support from an engineer.

⁴ 47 C.F.R. §1.3.

⁵ *WAIT Radio v. FCC*, 418 F.2d 1153, 1157 (D.C. Cir. 1969).

⁶ Waiver Request at 11.

⁷ *Id.*

Finally, SafeView has not sought a waiver to permit the average power level of its devices to exceed the limits of Section 15.209(a) by 41 dB, or 12,600 times.

These deficiencies are grounds enough for dismissing SafeView's Waiver Request. The HNS interference analysis below provides an entirely separate basis for dismissing SafeView's request.

B. SafeView Seeks to Exceed Section 15.209(a) Limits by a Factor of 12,600

Part 15 of the Commission's rules governs the operation, manufacture, and marketing of unlicensed radio frequency devices.⁸ Part 15 devices may not cause harmful interference to licensed services:⁹ the operation of Part 15 devices is subject to the condition that "no harmful interference is caused."¹⁰ Should harmful interference occur to licensed users of the radio frequency spectrum, the operator of the offending Part 15 device is required to cease operation.

In an effort to decrease the likelihood of interference to licensed services, while still allowing the use of Part 15 devices by the public on an unlicensed basis, Part 15 transmitters, like SafeView's device, generally are restricted to very low field strengths. Specifically, the rules provide that the field strength of radiated emissions from intentional radiators operating above 960 MHz at a distance of 3 meters shall not exceed 500 $\mu\text{V/m}$,¹¹ which translates into a power density of -41.25 dBm. This is the average permissible power level, with

⁸ 47 C.F.R. §15 *et seq.*

⁹ 47 C.F.R. §15.5(b).

¹⁰ *Id.* Harmful interference is defined as "any emission, radiation, or induction that . . . seriously degrades, obstructs, or repeatedly interrupts a radio communications service operating in accordance with this chapter." 47 C.F.R. §153(m).

¹¹ 47 C.F.R. §15.209(a).

peak emissions constrained to 20 dB above the maximum permitted average level.¹² The Commission has recognized that such limits on radiated emissions are necessary to guard against interference to licensed services from unlicensed Part 15 devices.¹³

SafeView seeks to operate its transmitters at a power level *12,600 times greater* than permitted by Section 15.209(a) of the Commission's rules.¹⁴ By SafeView's own admission, the peak and average radiated emissions for its device are the same -- 0 dBm EIRP.¹⁵ Thus, its request for a waiver of the peak limits is a "red herring." What SafeView really needs is a waiver to allow it to exceed by 41 dB the maximum permissible average emission level specified in Section 15.209(a). As demonstrated below, allowing SafeView to operate at an average power of 0 dBm would significantly increase the likelihood of interference to licensed services operating in the 24.25-30 GHz frequency bands.

C. **SafeView's Device Poses an Interference Threat to Licensed Devices**

HNS is one of the manufacturers of microwave communications equipment for licensees operating in the 24 and 28 GHz frequency bands, which supports point-to-multipoint communications over short ranges. This equipment, which is characterized by its ability to maintain very low error rates, is designed to be an effective replacement for, or alternative to, short-hop, fiber optic networks. This equipment, designated as the AB9000 series, can be installed on the top of a building in order to provide communications services utilizing standard

¹² 47 C.F.R. §15.37(b).

¹³ *Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without an Individual License*, First Report and Order, 4 FCC Rcd 3493, 3497 ¶¶24, 26 (1989) ("Part 15 Order").

¹⁴ SafeView seeks to operate its transmitters at a power density of 0 dBm -- 41 dB in excess the field strength permitted under the Commission's rules. Waiver Request at 10 n.5.

¹⁵ *Id.*

wireline distribution networks within the building. Alternatively, it can be installed indoors, with the antenna pointed to an internal local area network or out of a window.

End-users rely on the links supported by these licensed microwave communications devices to provide and access a wide variety of voice, data, and video services. For example, government agencies use the links to provide the backbone networks for municipal police, fire, and emergency communications systems. Cellular and personal communications service (“PCS”) operators use the links to interconnect sites, while other entities use them to provide cost-effective, intra-campus communications. In the event of an emergency or natural disaster, the small size and relative ease of installing these products makes them well suited for rapid deployment to replace or augment wireline services, particularly in the event of a natural disaster or other emergency.

1. **HNS’ Analysis Demonstrates Harmful Interference.**

Attached as Exhibit 1 is an interference analysis that HNS has conducted regarding the interference potential of the SafeView device into one model of this industry’s equipment, the HNS AB9000 product line. HNS has assumed that the main lobe of its receiving antenna would receive interference from one or more SafeView installations. In the case where multiple SafeView installations are visible to the main lobe of the terminal, HNS assumed that the interference would be additive in time. HNS’ interference analysis also takes into consideration customer expectations. The AB9000 series of terminals serves a market in which customers expect carrier-grade service that performs like a fiber optic network, and therefore requires a high level of performance. Accordingly, this equipment is designed to provide 99.99%+ availability,¹⁶ and support customer requirements for a bit error rates of 1 errored bit in

¹⁶ ITU-R Recommendation F.1400.

10^{12} or better. HNS's analysis assumes a -10 dB I/N,¹⁷ because the AB9000 equipment ceases to be a competitive fiber substitute if this criterion is not satisfied.

HNS has analyzed three different interference scenarios. The first scenario assumes no obstructions between the SafeView system and the AB9000 series equipment, (*e.g.*, where the SafeView equipment is installed outdoors or where the SafeView and fixed wireless access equipment are both installed in a building atrium). The other scenarios assume (i) a path loss of 5 dB, consistent with an off-axis antenna alignment, and (ii) a path loss of 10 dB, consistent with partial obstructions in the signal path.

The zones in which the fixed wireless access equipment would be susceptible to harmful interference from a SafeView device, based on the different scenarios, are shown in Table 4 of Exhibit 1. In a worst case scenario, HNS concludes that fixed wireless access equipment oriented towards the SafeView equipment would receive harmful interference from a device located within 9134 meters or 4.93 miles.

Microwave communications equipment customers expect and deserve to receive high quality service from their licensed equipment. If the Commission grants the Waiver Request, however, the SafeView system is likely to cause harmful interference to those users. The impact of this interference would be particularly acute because the interference lasts for a short duration but at regular intervals, thereby resulting in a few degraded bits every few seconds without otherwise impacting the link. As a consequence, customers and certain maintenance personnel are unlikely to associate the on-going reduction in BER to interference from the SafeView system. Rather, they are more likely to misdiagnose the problem as a malfunction of the fixed wireless access equipment. If the enduser is unable to identify the source of the

¹⁷ *Id.* at F.1094-1.

interference (as is likely to be the case), the customer will not be able to exercise its right to have the SafeView device immediately cease operations, as required by the Commission's Part 15 rules. As the Commission itself has recognized, the agency's job is to balance the needs of the public for the services provided by Part 15 devices with its obligation to ensure that these unlicensed devices do not cause harmful interference to licensed services.¹⁸

2. **SafeView Underestimates the Level and Duration of Interference.**

Although SafeView fails to provide a Part 15 interference analysis, it does attempt to explain why its device will not cause harmful interference to any victim receivers operating in the 24.25-30 GHz frequency bands. SafeView's claims that interference from its transmitter to licensed services is mitigated by the transmitter's low duty cycle. Although a low duty cycle reduces the amount of time during which interference could occur, the interference is not negligible, for the reasons provided above. SafeView's duty cycle calculations significantly underestimate the impact of its device on licensed services.

a. **The use of 20*LOG underestimates the duty cycle.**

SafeView further miscalculates the duty cycle of its devices. Standard engineering practices dictate that SafeView should have calculated the duty cycle using 10*LOG, rather than the 20*LOG factor that SafeView uses. Use of 10*LOG results in interference of:

$$\text{Duty Cycle (dB)} = 10*\log(1.8\text{s}/10\text{s}) + 10*\log(3.09\text{ms}/8.6\text{ms}) +$$

$$10*\log(9.09\text{ns}/8.08\text{us}) = -41.4 \text{ dB}$$

or 1/1,3740 of the time, as opposed to 1/200,000,000 of the time, as SafeView claims.

Accordingly, SafeView grossly underestimates the duty cycle of its transmitter.

¹⁸ Part 15 Order, 4 FCC Rcd at 3495 ¶¶6-12.

- b. SafeView wrongly assumes that only one SafeView transmitter will be operating at a given location.

SafeView underestimates the level of interference to licensed services by assuming that only one of its transmitters is likely to be operating in a specific location at a given time. To the contrary, airport security checkpoints are likely to operate multiple transmitters simultaneously in close proximity to one another. As a result, the potential interference duration should be multiplied in time by the number of transmitters in close proximity that are operating simultaneously. The Commission must take into consideration the impact of multiple SafeView transmitters operating at the same time in close proximity to one another, such as in airports.

- c. A 10 MHz channel is not representative of licensed systems deployed at 24 GHz or 28 GHz.

In calculating the interference potential of a SafeView transmitter, the duty cycle is directly proportional to the receiver bandwidth for a linear frequency ramp waveform. SafeView incorrectly assumes that the channel bandwidth of a receiver in the 24.25-30 GHz frequency bands is 10 MHz.¹⁹ Although AB9000 equipment uses a channel bandwidth of 12.5 MHz, other receivers in LMDS frequency bands typically operate with channel bandwidths of 100 MHz up to almost 1 GHz. Based on its erroneous assumption that the channel bandwidth of a receiver in the 24.25-30 GHz frequency bands is 10 MHz, SafeView estimates its duty cycle to be -83 dB or 1/200,000,000 of the time.²⁰ This miscalculation underestimates the degree of potential interference because it fails to consider larger channel bandwidths, which are common in the 24 and 28 GHz bands. In the case of a system operating with 100 MHz of bandwidth, for

¹⁹ Waiver Request at Appendix A.

²⁰ *Id.* at 11.

example, the interference would be 91 nanoseconds per 8.1 microseconds or 1.1 percent, yielding interference that lasts almost as long as the symbol time.²¹

3. **SafeView Fails to Demonstrate Why a Reduction in the Power of its Devices is not Feasible at this Time.**

SafeView claims that operation of its device at reduced power “may prove feasible over the long term.”²² But SafeView fails to explain why such a reduction in power is not feasible at this time. The Commission should require SafeView to demonstrate why “at the current state of the technology” SafeView is unable to comply with the Commission’s emissions limits.

4. **SafeView’s Proposed Conditions are Insufficient to Reduce Interference to Licensed Services.**

SafeView proposes two conditions on the operation of its devices to “help limit interference.”²³ Neither of these proposals is a workable solution to the potential interference problem. First, SafeView proposes to create and maintain a database of its installations that would include the identity of the SafeView customer and the location of the device, but would be made available on request only to the Commission or to NTIA. The confidential treatment of this information renders the data useless to licensed users who experience interference because the interference victim would not even know about the operations of a SafeView device in the vicinity of its licensed equipment, and therefore would not be able to identify it as a possible source of interference.

²¹ “Symbol time” is defined as the basic unit of time over which a unit of information is transmitted over a communications channel. A symbol may contain one or more information bits.

²² Waiver Request at 10.

²³ *Id.* at 12-13.

Second, SafeView proposes to limit the number of devices installed in the first and second years. The Waiver Request makes no mention of what happens beyond the first and second years of installation. Moreover, no conclusions could be drawn from the operation of SafeView devices in the first two years because many wireless service providers have just started to deploy licensed systems in the 24.25-30 GHz frequency bands.²⁴ As a result, they may not yet have built out in those areas where SafeView transmitters are deployed in the first two years.

5. **SafeView Fails to Demonstrate Why it Cannot Reduce Emissions by Shielding its Devices.**

SafeView wrongly claims that the only way to shield emissions from its device would be to install a metal structure that would compromise the performance of the device. To the contrary, a variety of other energy-absorbing shielding products exist in the marketplace that SafeView could use to reduce the interference susceptibility to licensed services operating in the 24.25-30 GHz bands. HNS has investigated the technical feasibility of reducing unwanted emissions that radiate from the SafeView system. As depicted in Exhibit 2, one solution would be to install behind the moveable antenna subsystem a microwave absorber supported with conductive shielding. Under this approach, the microwave absorber would subtend the 41 dB beamwidth of the antenna on the opposite side of the structure from the subject. Notably, this particular placement of the absorber would prevent emissions from radiating outside the structure, while simultaneously avoiding multipath problems within the environment. The absorber would rotate at the same time as the antenna subsystem.²⁵ Identical absorber panels could be placed on both sides of the cylinder.

²⁴ *Amendments To Parts 1, 2, 87 and 101 of the Commission's Rules To License Fixed Services at 24 GHz*, Report and Order, 15 FCC Rcd 16934 (2000); *Amendments To Parts 1, 2, 87 and 101 of the Commission's Rules To License Fixed Services at 24 GHz*, Order on Reconsideration, FCC 01-151 (rel. May 17, 2001).

²⁵ See Exhibit 2.

SafeView claims -- without providing any evidence -- that shielding its devices would increase both the size and the cost of the device.²⁶ Although SafeView indicates that each unit is expected to cost \$100,000, it says nothing about how much the size or the cost of the device would increase if it were required to mitigate the device's interference to licensed services.

HNS does not believe that it would be cost prohibitive for SafeView to install energy-absorbing material. HNS estimates that such shielding would add only a few hundred dollars to the overall cost of the unit. Companies such as Emerson & Cuming produce inexpensive commercial absorbers. Emerson and Cuming's product number HR-10, which is particularly suitable for operation in the 24.25-30 GHz frequency bands, is available in standard 2'x2' sheets.²⁷ This product could be fabricated with aluminum foil backing or applied to a metallic substructure to provide additional shielding.

Assuming a cylinder that is five feet in diameter and nine feet high and with 80% of the walls covered, the SafeView system would cover a surface area of 113 square feet. Assuming, in addition, 10% waste, the system would require 32 tiles of 4 square feet at a rate of less than \$10 per tile (for quantities exceeding 500 tiles), yielding an estimated cost of \$320 per unit for the absorber. Additional details regarding the antenna patterns likely would demonstrate the need for fewer tiles, thereby further reducing the cost of the absorber.

This data strongly suggests that the incremental cost of installing energy-absorbing materials in the lining of each SafeView unit far outweighs the impact of the harmful interference caused to licensed services if the absorption materials are not installed. HNS urges

²⁶ Waiver Request at 10-11.

²⁷ See Exhibit 3.

the Commission to require SafeView to line the devices with energy-absorbing materials, or take other measures to ensure that interference is not caused to licensed users in the band.

6. **SafeView's Other Assertions are Unsupported.**

SafeView makes a number of unsupported assertions in support of its claim that its devices do not pose an interference threat.

SafeView claims that all of its devices will be installed indoors. There is nothing in SafeView's Waiver Request to assure the Commission that such devices will be installed indoors only. In fact, by SafeView's own admission, the devices could be installed at entertainment venues, which could encompass football stadiums or outdoor concert halls,²⁸ or outdoors at airports such as those in Hawaii. In such a case, there could be little or no signal attenuation toward a nearby licensed device.

SafeView erroneously assumes that none of the licensed devices in the 24.25-30.0 GHz band operates indoors when it states that building attenuation will reduce interference to licensed services. To the contrary, much of the microwave communications equipment in this band, including HNS', is suitable for use inside buildings, as described above, and therefore could be in close proximity to one of the SafeView devices.

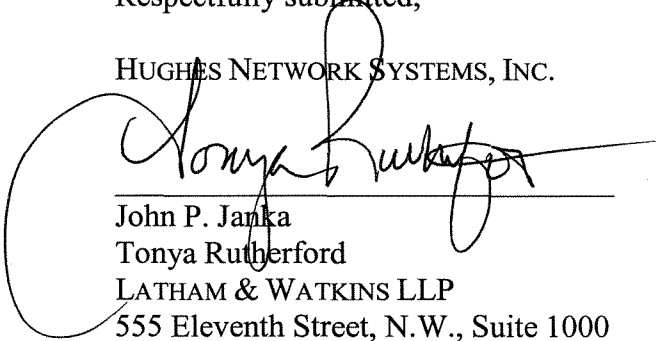
²⁸ Waiver Request at 4.

III. CONCLUSION

For the reasons described above, HNS urges the Commission to dismiss or deny SafeView's Waiver Request, and to require SafeView to conform its equipment to the Part 15 rules.

Respectfully submitted,

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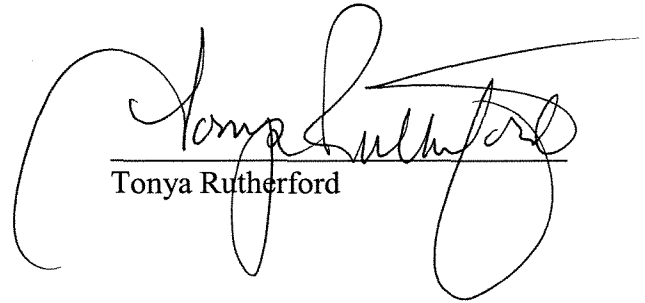
(202) 637-2200

October 22, 2004

CERTIFICATE OF SERVICE

I hereby certify on this 22nd day of October 2004 that a true and correct copy of the foregoing Opposition to Request for Waiver filed by Hughes Network Systems, Inc. was deposited in the U.S. mail, first-class, postage prepaid, addressed to the following:

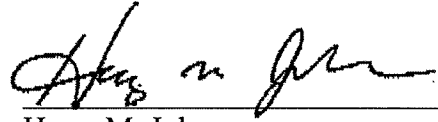
Mitchell Lazarus
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Tonya Rutherford

Technical Certificate

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in the foregoing Opposition, that I am familiar with Part 15 of the Commission's Rules, that I have either prepared or reviewed the engineering information submitted in the Opposition, and that it is complete and accurate to the best of my knowledge.

A handwritten signature in black ink, appearing to read "Harry M. Johnson", written over a horizontal line.

Harry M. Johnson
Senior Director, Technical Hardware
Hughes Network Systems

Exhibit 1

Interference Analysis

The AB9000 series receivers manufactured by HNS are characterized by the parameters listed in Table 1 for the remote terminals and Table 2 for the hub terminals. It is critical to note that, because the AB9000 series of terminals serve a market where the customer expects carrier grade service with performance similar to that demanded by fiber optic networks, a high level of performance is required on the link. As such, the availability expectation is 99.99+%¹ and bit error rates of 1 errored bit in 10¹² or better are often required. Based on this background, a -10 dB value of I/N^2 is necessary to meet the Quality of Service (QOS). If the -10 dB I/N criteria is not met, then the AB9000 product ceases to be a viable fiber replacement solution to the product users.

In addition, it bears mention that the AB9000 terminals use automatic transmit power control (ATPC), which allows for greater reuse of frequency channels in the network by minimizing inter-system interference while still providing high availability performance in the presence of precipitation. As a result, in order to maximize the network capacity, the AB9000 is optimized to operate with minimum transmit power using high order QAM modulation. However, the short duration of the SafeView interference waveform would not be compensated for by the ATPC, which has been designed for rain attenuation and more slowly varying interference conditions.

¹ ITU-R Recommendation F.1400.

² *Id.* at F.1094-1

TABLE 1 – REMOTE TERMINAL CHARACTERISTICS	
Frequency Plan	24.25 to 24.45 GHz 25.05 to 25.25 GHz 27.5 to 28.35 GHz 29.10 to 29.25 GHz
Channel Bandwidth	12.5 MHz
Threshold I/N	-10 dB
Antenna boresight gain	43 dBi
System noise figure	6 dB

TABLE 2 – HUB TERMINAL CHARACTERISTICS	
Frequency Plan	24.25 to 24.45 GHz 25.05 to 25.25 GHz 27.5 to 28.35 GHz 29.10 to 29.25 GHz
Channel Bandwidth	12.5 MHz
Threshold I/N	-10 dB
Antenna boresight gain	16 dBi
System noise figure	6 dB

HNS has reviewed SafeView's Waiver Request and has extracted the technical parameters relevant in assessing the impact of a SafeView system to an HNS AB9400 or AB9600 terminal. These SafeView parameters are summarized in Table 3.

TABLE 3 – SAFEVIEW CHARACTERISTICS	
Frequency Band	24.25 to 30 GHz
EIRP	0 dBm
Sweep Time	6 μ S
Element Sweep Duty Cycle	$6\mu\text{S}/8.1\mu\text{S} = 74\%$
Angle Sweep Duty Cycle	$3.1\text{mS}/8.6\text{mS} = 36\%$
Active Duty Cycle	$2\text{Sec}/10\text{Sec} = 20\%$
Total Duty Cycle	$20\%*36\%*74\%=5.3\%$

An analysis of the compatibility of the systems was done assuming three different blockage scenarios. The first assumes that there is no obstruction between the SafeView system and the AB9000. This scenario is likely to happen in cases where the SafeView and HNS equipment are both installed in a building atrium (*e.g.*, Dulles Airport main terminal), where the SafeView equipment is installed outside (*e.g.*, Hawaii airports, where current metal detectors are located outdoors), or where the SafeView device is installed in a building lobby and there is little or no physical obstruction blocking the signal from an outside mounted antenna. (The additional path loss of window glass with no metallization is approximately 0dB.) Two other scenarios have been considered for path losses of 5 and 10 dB which are consistent with off axis antenna alignment or partial obstructions.

The analysis assumes that the interference from one or more SafeView installations would be received in the main lobe of the receiving station antenna. In the case when multiple SafeView installations are visible in the main lobe of the terminal, it is assumed that the interference will be additive in time. As a consequence, the interference will be seen to sweep

across more frequently, although the power of the interference should be approximately the same.

Based on an interference threshold consisting of an I/N value of -10 dB, the interference susceptibility zone for each case is shown in Table 4. Additional details regarding the calculations are available in Annex 1.

TABLE 4 – INTERFERENCE SUSCEPTIBILITY ZONE			
	Building Attenuation (dB)		
Unit Type	0	-5	-10
Remote	9134 meters	5137 meters	2888 meters
Hub	408 meters	229 meters	129 meters

From the greater distances above, it is possible to see that the SafeView system as designed has the potential to significantly disrupt the operation of AB9000 equipment manufactured by HNS. The impact is particularly significant in that the interference is of very short duration, resulting in a few degraded bits every few seconds without otherwise impacting the link. Customers and first level maintainers would be unlikely to associate the on-going reduction in BER to interference from a system such as SafeView, and would likely and erroneously diagnose the problem as an equipment malfunction. Identifying the source of the interference cannot be reasonably found without complex test equipment and highly trained maintenance staff. Consequently, it will be difficult for licensed customers to exercise their right to have the unlicensed operator cease its operations, as required under Part 15 of the Commission's rules. It also makes it very likely that HNS will lose equipment sale contracts and customer goodwill could be lost as a result of the interference received.

ANNEX 1 (1 of 6)

Interference to HNS Remote 0dB

Frequency	2.80E+10	Hz
Wavelength	0.010714286	meters
Interference to Noise	-10.00	dB
AB9000 System NF	6.00	dB
Interference density	-178.00	dBm/Hz
AB9000 Channel BW	1.25E+07	Hz
Interference level	-107.03	dBm
Interference Sweep rate	1.10E+15	Hz/sec
Interference time	1.14E-08	Sec
Symbol time	1.00E-07	Sec
Interference duty cycle	-9.43	dB
Pathloss obstruction	0.00	dB
Antenna Gain	43.00	dBi
Transmit Power	0	dBmi
Path loss	-1.41E+02	dB
Range Calculated	9134	meters

ANNEX 1 (2 of 6)

Interference to HNS Remote 5dB

Frequency	2.80E+10	Hz
Wavelength	0.010714286	meters
Interference to Noise	-10.00	dB
AB9000 System NF	6.00	dB
Interference density	-178.00	dBm/Hz
AB9000 Channel BW	1.25E+07	Hz
Interference level	-107.03	dBm
Interference Sweep rate	1.10E+15	Hz/sec
Interference time	1.14E-08	Sec
Symbol time	1.00E-07	Sec
Interference duty cycle	-9.43	dB
Pathloss obstruction	5.00	dB
Antenna Gain	43.00	dBi
Transmit Power	0	dBmi
Path loss	-1.36E+02	dB
Range Calculated	5137	meters

ANNEX 1 (3 of 6)

Interference to HNS Remote 10dB

Frequency	2.80E+10	Hz
Wavelength	0.010714286	meters
Interference to Noise	-10.00	dB
AB9000 System NF	6.00	dB
Interference density	-178.00	dBm/Hz
AB9000 Channel BW	1.25E+07	Hz
Interference level	-107.03	dBm
Interference Sweep rate	1.10E+15	Hz/sec
Interference time	1.14E-08	Sec
Symbol time	1.00E-07	Sec
Interference duty cycle	-9.43	dB
Pathloss obstruction	10.00	dB
Antenna Gain	43.00	dBi
Transmit Power	0	dBmi
Path loss	-130.60	dB
Range Calculated	2888	meters

ANNEX 1 (4 of 6)

Interference to HNS Hub 0dB

Frequency	2.80E+10	Hz
Wavelength	0.010714286	meters
Interference to Noise	-10.00	dB
AB9000 System NF	6.00	dB
Interference density	-178.00	dBm/Hz
AB9000 Channel BW	1.25E+07	Hz
Interference level	-107.03	dBm
Interference Sweep rate	1.10E+15	Hz/sec
Interference time	1.14E-08	Sec
Symbol time	1.00E-07	Sec
Interference duty cycle	-9.43	dB
Pathloss obstruction	0.00	dB
Antenna Gain	16.00	dBi
Transmit Power	0	dBm
Path loss	-113.60	dB
Range Calculated	408	meters

ANNEX 1 (5 of 6)

Interference to HNS Hub 5dB

Frequency	2.80E+10	Hz
Wavelength	0.010714286	meters
Interference to Noise	-10.00	dB
AB9000 System NF	6.00	dB
Interference density	-178.00	dBm/Hz
AB9000 Channel BW	1.25E+07	Hz
Interference level	-107.03	dBm
Interference Sweep rate	1.10E+15	Hz/sec
Interference time	1.14E-08	Sec
Symbol time	1.00E-07	Sec
Interference duty cycle	-9.43	dB
Pathloss obstruction	5.00	dB
Antenna Gain	16.00	dBi
Transmit Power	0	dBmi
Path loss	-108.60	dB
Range Calculated	229	meters

ANNEX 1 (6 of 6)

Interference to HNS Hub 10dB

Frequency	2.80E+10	Hz
Wavelength	0.010714286	meters
Interference to Noise	-10.00	dB
AB9000 System NF	6.00	dB
Interference density	-178.00	dBm/Hz
AB9000 Channel BW	1.25E+07	Hz
Interference level	-107.03	dBm
Interference Sweep rate	1.10E+15	Hz/sec
Interference time	1.14E-08	Sec
Symbol time	1.00E-07	Sec
Interference duty cycle	-9.43	dB
Pathloss obstruction	10.00	dB
Antenna Gain	16.00	dBi
Transmit Power	0	dBmi
Path loss	-103.60	dB
Range Calculated	129	meters

EXHIBIT 2

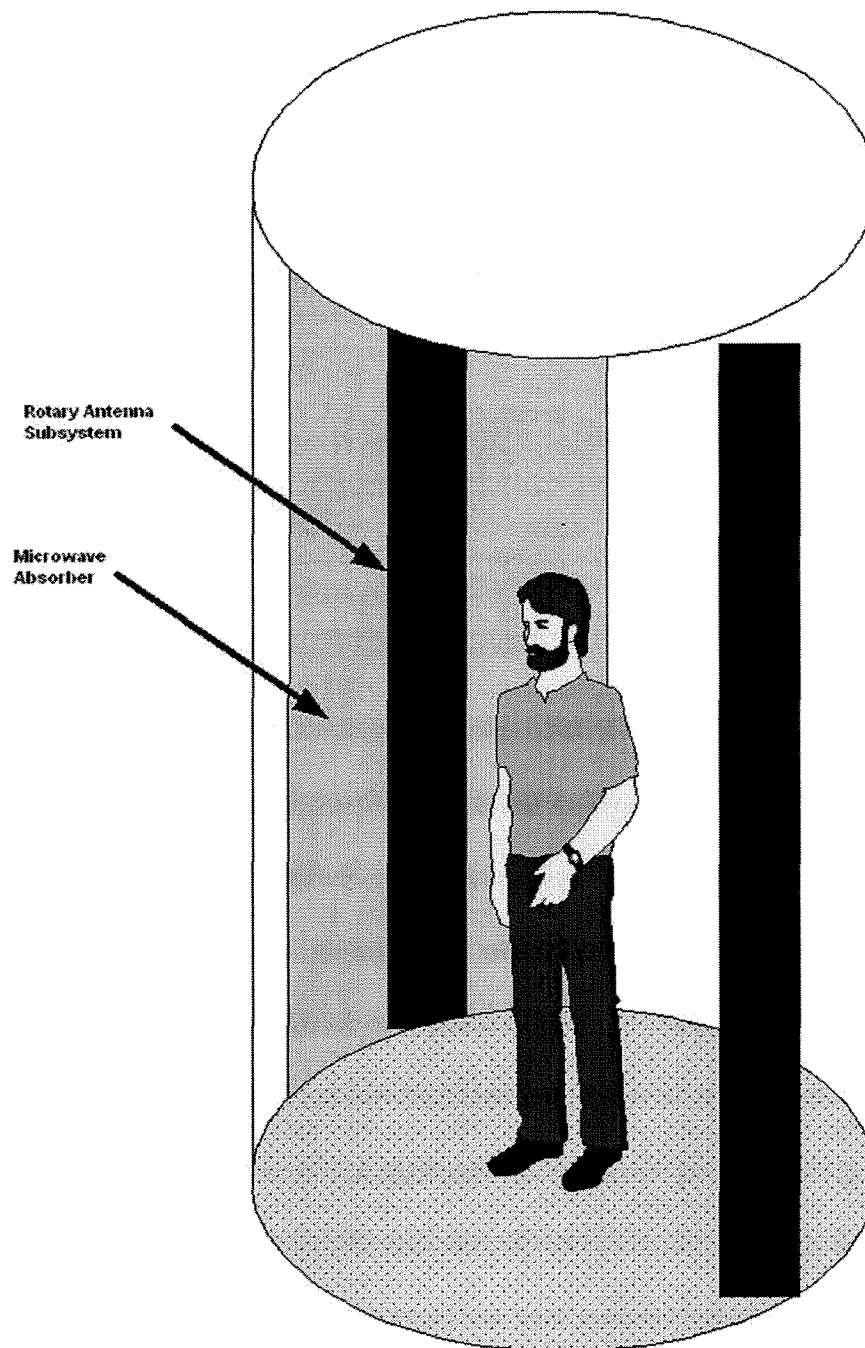


EXHIBIT 3

ECCOSORB® HR

Lightweight Flat-Sheet Broadband Microwave Absorbers

Material Characteristics

- Lightweight, flexible, flat-sheet broadband absorber
- Reticulated (open-cell) polyurethane foam sheet with a controlled conductivity gradient carbon loading system
- Electrically conductive
- Frequency range from 5 - 40 GHz
- Back surface is marked: HR-xx BACK
- Not weatherproof

Applications

- Antenna shrouds for low side-lobe reflector antennas
- Isolation of adjacent antennas and array elements
- Various camouflaging and interference suppression applications
- Military radar absorbing blankets providing stealth
- ECCOSORB® HR has been used for moderate performance anechoic chambers and less sensitive regions of high performance chambers

Availability

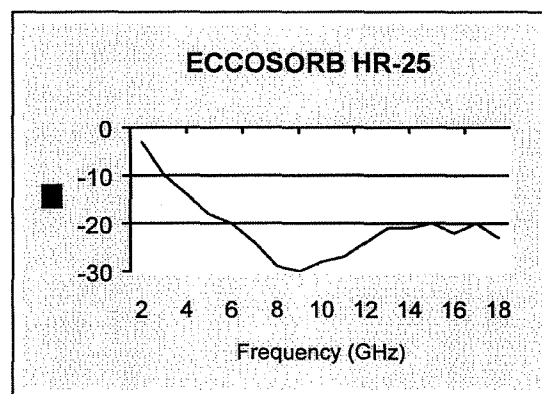
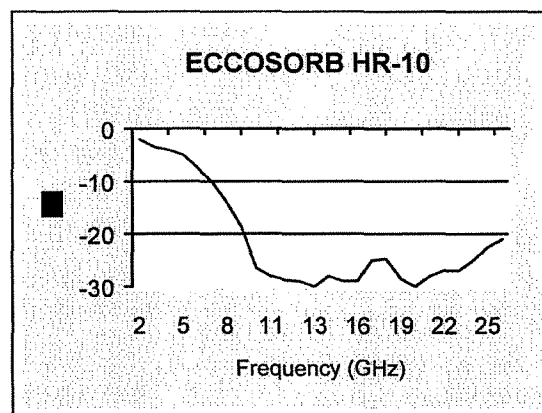
- Standard sheets are 24" x 24" (61 cm x 61 cm)
- Two standard thicknesses: ECCOSORB® HR-10 (10 mm) and ECCOSORB® HR-25 (25mm)
- ECCOSORB® HR is available in other sizes and customer specified configurations upon request

Typical Properties

	HR-10	HR-25
Density lb/ft ³ (kg/m ³)	2.8 (45)	2.8 (45)
Weight per 24" x 24" sheet, Lbs.	0.38	0.93
Tensile Strength (kPa)	70	70
Elongation (%)	170	170
Max. Service Temperature, °F (°C)	194 (90)	194 (90)
Frequency Range (GHz)	12-40	5-27
Reflectivity	>20dB	>20dB

Typical Reflectivity for ECCOSORB® HR

Results will vary depending on application.



Instructions for Use

- The front surface should face the incident electromagnetic energy for proper performance. To decipher from front and back, the back side of each panel is marked (HR-xx BACK)
- ECCOSORB® HR should be bonded to a metal surface for optimal performance. If a metal surface is not available, it can be supplied with an aluminum foil backing (ML) designated as HR-XX/ML
- ECCOSORB® HR can be bonded with the preferred adhesive ECCOSTOCK® [13-111-NF](#)